

Quantum Calorimeters Based on HgCdTe Alloys, Phase II

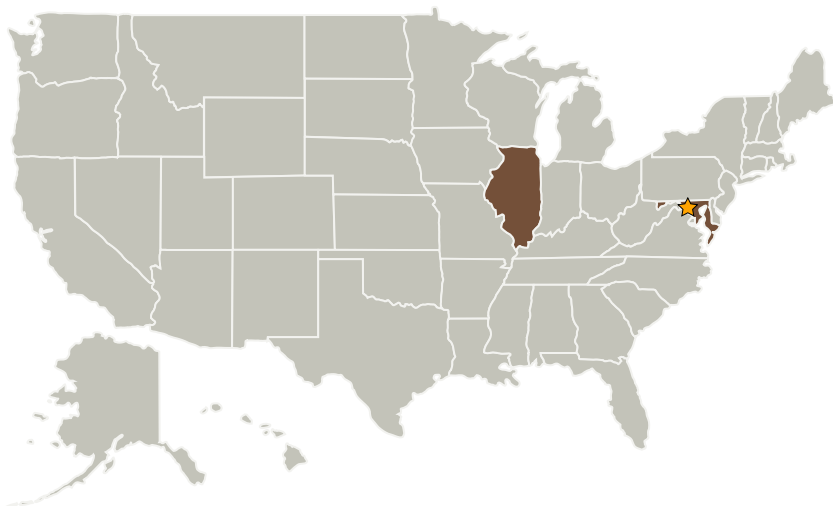
Completed Technology Project (2007 - 2009)



Project Introduction

NASA's next generation of x-ray observation missions require x-ray calorimeters with superior energy resolution. Semimetallic HgTe has already proven itself as an excellent soft x-ray absorber material due to its low heat capacity. Hg_{0.834}Cd_{0.166}Te was shown in Phase 1 to have a heat capacity superior to that of HgTe. Hence Hg_{0.834}Cd_{0.166}Te-based microcalorimeter arrays are expected to have an energy resolution superior to that of HgTe-based ones. We propose the growth of single crystal Hg_{0.834}Cd_{0.166}Te layers by molecular beam epitaxy on Si substrates. Mercury vacancies will be filled after growth to reduce the possibility of them acting as acceptors and introducing a significant electronic heat capacity. The samples will be characterized by x-ray diffraction to assess their structural quality and crystallinity, FTIR mapping to confirm the uniformity of their energy gaps and alloy compositions, Hall measurements to assess their electrical transport properties, etch pit density counts to determine dislocation densities, transmission electron microscopy to determine microscopic structural information, and heat capacity and thermalization efficiency measurements at mK temperatures. These assessments will further test their promise as high energy resolution quantum calorimeters and will help optimize material and processing parameters. The thermal property measurements will be performed on samples specially processed to remove some or all of the Si substrates and CdTe buffer layers. Finally, the development of a broadband infrared/mm wave reflective coating will be undertaken. The produced samples will be compatible with incorporation into microcalorimeter arrays for NASA missions.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland
EPIR Technologies, Inc.	Supporting Organization	Industry Small Disadvantaged Business (SDB)	Bolingbrook, Illinois

Primary U.S. Work Locations

Illinois	Maryland
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Project Transitions

-  **December 2007:** Project Start
-  **December 2009:** Closed out

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX08 Sensors and Instruments
 - └ TX08.1 Remote Sensing Instruments/Sensors
 - └ TX08.1.1 Detectors and Focal Planes